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## ABSTRACT

A study examined whether the reading comprehension of students with rich domain-specific knowledge will be better than that of students without it and whether assessed general skills will be correlated significantly with reading comprehension performance for students without specific knowledge, but negligible for the students with much specific knowledge. Subjects, 36 undergraduate engineering students and 321 music students enrolled in educational psychology courses, were first asked to read the music text and then take the comprehension test. Next they were given the engineering text and the corresponding comprehension test, and finally the Critical Thinking Appraisal test. Results showed that relying on domain-specific knowledge is more effective than relying on general reading skills as the basis for constructing representation, and that general reading skills made a significant contribution to reading comprehension for students who did not have content-specific knowledge, but a negligible one for students who did. (Tables of findings are included.) (EL)

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Domain-Specific Knowledge and General Skills  
in Reading Comprehension

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It has been well established that domain-specific substantive knowledge plays an important role in the understanding and memorizing of a text (Anderson, et al., 1977; Steffensen, et al., 1979; Chiese, et al., 1979): Experts with rich knowledge understand and retain a text in the domain much better than novices. On the other hand, some researchers have tried to enhance reading comprehension by teaching general metacognitive skills of reading irrespective of contents (Palincsar & Brown, 1984; Collins & Smith, 1982; Dansereau, et al., 1979).

How are domain-specific knowledge and general skills related in reading processes? As Glaser (1984) put it, in novel situations where students lack domain-specific knowledge, they have to rely on general skills, but in a domain where they possess much knowledge, general skills may be less important.

The purpose of the present study was to show the contribution of domain-specific content knowledge and general skills to the reading comprehension of texts. We assume that, since such specific knowledge is more effective than general skills, as the basis for the construction of a coherent representation experts

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with such knowledge will mostly rely on it, while novices, without the specific knowledge, will have to rely on general reading skills. The following two hypotheses are derived from this assumption: 1) The performances in reading comprehension of those students who have rich domain-specific knowledge will be better than that of the students who do not; 2) assessed general skills will be correlated significantly with reading comprehension performance for the students without the specific knowledge, but this correlation will be negligible for the students with much specific knowledge.

### Method

#### Subjects

Subjects were 36 undergraduates majoring in engineering who were enrolled in an educational psychology course at the Tokyo Institute of Technology and 321 students majoring in music who were enrolled in educational psychology courses at Kunitachi College of Music. Though a test of specific knowledge was not given, it was supposed that the students majoring in engineering had much more specific knowledge of engineering and much less of music than the students majoring in music, and vice versa.

#### Materials

Reading texts. Two texts were prepared: one on engineering and one on music. The text on engineering was from the first chapter of the book entitled "Introduction to Knowledge Engineering" by Fumio Mizoguchi and Katsuaki Kitazawa (1982) with a little omission. The text described recent advances in knowledge engineering using examples of intellectual information

processing systems, GUS and SCHOLAR. The text on music was an essay from "Review of Music" written by Hidekazu Yoshida (1981). The essay consisted of comments on recitals of a pianist, Christoph Eschenbach, over three periods and also on music education in Japan.

Tests of reading comprehension. The reading comprehension test for each text consisted of two parts. The first major part included multiple-choice questions to check understanding of the main ideas: 9 questions for the knowledge engineering text and 15 for music. The second part included 4 multiple-choice questions to check instantiation. In the instantiation questions students were asked their representation of contents that were not described explicitly in the text, e. g., "How do people communicate with GUS? 1. via sounds, 2. via letters on a screen, 3. via both sounds and letters, 4. I can't imagine". The proportion correct for the first part was referred to as the comprehension ratio, and the second part as the instantiation ratio. The test was given after the corresponding text was collected, so it measured the extent of both comprehension and retention.

Test of general reading skills. General reading skills were measured by the Japanese revised version of the Watson-Glaser Critical Thinking Appraisal. This test required a student to read discourses and statements derived by one of four types of reasoning from each discourse, and to judge the plausibility of the statements: 1) formal class reasoning (2 items); 2) fuzzy class reasoning, including induction (8 items); 3) abbreviated fuzzy conditional reasoning (6 items); and 4) recognition of

presupposition (4 items). The maximum score was 20.

#### Procedures

Students were first given the text of music and asked to read it silently for 10 minutes. After the text was collected, they were given the comprehension test without the text for 10 minutes, the engineering text for 10 minutes and the corresponding comprehension test for 8 minutes. Finally they were administered the Critical Thinking Appraisal for 12 minutes.

#### Results

Matching of subjects: The mean scores of the critical thinking test were 12.1 ( $SD = 2.7$ ) for the 36 engineering students and 8.3 ( $SD = 2.7$ ) for the 321 music students. Out of these 321 music students 36 students were individually matched with the 36 engineering students by critical thinking test score and the data of these 36 selected pairs were compared.

1. Comparison of mean proportions correct of the reading comprehension test: The mean proportions correct for both groups are presented in Table 1. The instantiation ratio showed that the students who had domain-specific knowledge were significantly better than the students who did not have it,  $t(70) = 2.56$ ,  $p < .05$  for the engineering text;  $t(70) = 3.13$ ,  $p < .01$  for the music text. The engineering text showed the same pattern as the instantiation ratios: engineering students showed a significantly higher score than music students,  $t(70) = 3.47$ ,  $p < .01$ . However, on the music text the expected difference in the comprehension ratios between music students and engineering students was not observed.

2. The correlations between the reading comprehension and

general reading skills: The correlation coefficients between the comprehension ratios and critical thinking score (measure of general reading skills) are shown in Table 2. As expected, only the comprehension ratios of students without content-specific knowledge, i.e., the ratios of engineering students for music text and of music students for engineering text, were correlated significantly with the score of the critical-thinking test. The comprehension ratios of the students with content-specific knowledge, i.e., the ratios of engineering students for engineering text and of music students for music text, were correlated insignificantly with the critical-thinking score. However, differences of the two correlations from the same samples were not significant.

None of the correlations between the instantiation ratios and the critical-thinking score was significant. The aspect of reading comprehension represented by the instantiation ratios was probably not enhanced by general reading skills, even when the relevant domain-specific knowledge was just poor.

#### Discussion

Hypothesis 1 was supported for the instantiation ratios on both texts. These results were consistent with the assumption that relying on domain-specific knowledge would be more effective than relying on general reading skills as the basis for constructing representation, though the results may be interpreted in terms of retrieval or reconstructing the answers for the comprehension test items. The present results corroborated those obtained by Steffensen et al. (1979) revealing

that subjects from a specific culture produced culturally appropriate extensions more for text pertinent to that culture.

As to the comprehension ratios Hypothesis 1 was only partially supported: On engineering text the results were consistent with the assumption, but the results on music text were not. Why did not our music students with much knowledge of music show higher comprehension ratios than the engineering students? This may be interpreted as follows: Music students may have formed more detailed, appropriate representation for music text than the engineering students, as suggested from their instantiation ratios, but these representational differences may not have been reflected in comprehension ratios, because the music students were much less skillful in test-taking than the engineering students. It could be reasonably assumed that the engineering students had been trained in the test situation and that those reading comprehension tests they had taken included only "comprehension" test items, not "instantiation" items. An informed observation of the experiment supported this interpretation: the engineering students finished each step faster and had longer time between steps than the music students. Among the music students there would be some who were poor at test-taking skills or low in testwiseness (See Dreisbach & Keogh, 1982), and this variable could be one of the determinants of comprehension, while the engineering students, from a very prestigious university, would supposedly be uniformly high in the skills. The correlation of comprehension ratios between engineering text and music text was significant only for the music students,  $r(36) = .441$ ,  $p < .01$ , and even when the effect

of critical-thinking scores was partialled out, the correlation was still significant,  $r(33) = .422$ ,  $p < .05$ . For such students, it would be difficult to show a higher proportion correct than .74.

Hypothesis 2 was supported, though not as clearly as had been hypothesized. The data demonstrate that general reading skills made a significant contribution to reading comprehension for students who did not have content-specific knowledge, but a negligible one for students who did. This was also supported by the following data analysis. Since our subjects were individually matched, we could calculate four inter-subject correlation coefficients on comprehension ratios: correlation coefficient between engineering students' ratios for engineering and the matched music students' ratios for engineering, engineering students' ratios for engineering and music students' ratios for music, engineering students' ratios for music and music students' ratios for engineering, and engineering students' ratios for music and music students' ratios for music. Only the correlation coefficient between engineering students' ratios for music and music students' ratios for engineering, both assumed to reflect general reading skills, was significant,  $r(36) = .396$ ,  $p < .05$ .

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Table 1

## Mean Proportions Corect Reading Comprehension Test

| Text                | College     |       | a<br>Difference |
|---------------------|-------------|-------|-----------------|
|                     | Engineering | Music |                 |
| Comprehension ratio |             |       |                 |
| Engineering text    | 0.72        | 0.62  | E > M **        |
| Music text          | 0.76        | 0.74  |                 |
| Instantiation ratio |             |       |                 |
| Engineering text    | 0.49        | 0.37  | E > M *         |
| Music text          | 0.31        | 0.51  | E < M **        |

Note. <sup>a</sup> difference between music students and engineering students.

\*\*p < .01. \*p < .05.

Table 2

Correlations between Comprehension Ratios and  
Critical Thinking Score

| Text             | College     |       |
|------------------|-------------|-------|
|                  | Engineering | Music |
| Engineering text | .20         | .39*  |
| Music text       | .34*        | .15   |

Note. \*  $p < .05$  by two-tailed test.